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United States Army Advanced Medic (91B30) Training: An Iterative Decision Method Application

CPT Terry D. Carroll, M.A., M.Ed., Ph.D and
Kenn Finstuen, M.S., M.Ed., Ph.D.
Academy of Health Sciences, United States Army
Fort Sam Houston, Texas 78234

Abstract

This paper describes the first implementation of the Iterative Decision Method (IDM) for the selection of training tasks in the 91B30 Advanced Medical Specialist Course, US Army Academy of Health Sciences. The purpose of this research was to determine the feasibility of conducting front-end-analysis of medical training requirements with the IDM. Five expert judges were employed to select or nonselect 209 tasks, grouped into 13 modules, ranging from 3-58 medical tasks. In the first iteration, judges made independent selection decisions (J1). Task judgments were analyzed for goodness-of-fit ($\underline{R}$) and inter-rater reliability (r_{kk}). Next, judges met and reviewed the results. Discussion was directed to disagreed upon tasks. Revised group judgments (J2) followed, with consequent increases in $\underline{R}$ and r_{55}. For the largest module, Medical/Surgical Procedures, findings indicated J1-J2 increases of .55 to .93 for $\underline{R}$, and .38 to .96 for r_{55}. Finally, tasks were prioritized within modules based on 3-point task training ratings.

"The views of the authors are their own and do not purport to reflect the position of the Department of the Army or the Department of Defense."

Background

The Academy of Health Sciences (AHS), Fort Sam Houston, TX, has the responsibility for the development and implementation of training for over 30 enlisted medical military occupational specialties (MOS). Within the Academy's organizational framework, the Directorate of Training Development (DTD) holds primary purview for the delineation of training requirements for jobs and tasks within each medical MOS, and, in conjunction with the Directorate of Combat Development and Health Care Studies (DCDHCS), has the responsibility for revising training programs to meet emerging combat medical needs. The largest and most significant MOS which the Academy trains is the 91B Medical Specialist, with over 15,000 active and 22,000 reserve component positions authorized (7th largest MOS in the US Army). Prior training for this MOS consisted of a single Advanced Individual Training (AIT) phase ranging from 6 to 10 weeks. The possibility existed that a 91B medic could complete a 30-year career with only AIT and no additional mid-career MOS training. For any technical field, and in particular medical jobs, the resultant training deficiency is obvious. Further, analyses conducted by DCDHCS were conclusive in the identification of the need for combat medics to acquire new and sophisticated trauma skills for the treatment of casualties on middle to high intensity battlefields.

To remedy these problems, The Surgeon General of the Army, in February 1981, directed the Academy to develop a new Advanced Medical Specialist Course. An implementation date of April 1983 was targeted for the new 91B30 program.

The central problems confronting the developers of the 91B30 course consisted of the identification of job performance criteria, and the selection of tasks to be trained. Utilizing the Instructional Systems Development (ISD) technology (TRADOC, 1975), a number of task lists were prepared by various teaching elements within the Academy, viz., Medicine and Surgery, Physicians Assistant, and Special Forces Aidman. These lists were compiled by DTD and an initial Critical Task Selection Board (CTSB) was convened. Meeting twice in September 1981, the board selected 220 of 443 medical tasks for training. The board consisted of 20 Army Medical Department (AMEDD) personnel, 10 officers (O-3 to O-6) and 10 enlisted (E-6 to E-9).

A number of problems were encountered with the CTSB configuration, but the most significant areas were: a) the board spent inordinate amounts of time discussing items on which they agreed; b) rank and branch of service, rather than experience and expertise often influenced decision making; c) individual

participation was limited due to the size of the group; and d) semantic problems, particularly across professional lines, occurred frequently. Problems not withstanding, the initial 91B30 task list was reviewed and sanctioned by the AHS Commandant, 29 September 1981. While the task list contained numerous critical life saving duties, many Army medical professionals felt that the list was incomplete and additional tasks were requested to be added to the list by the Office of The Surgeon General (OTSG) and OTSG consultants.

The list underwent continued refinement during a Site Device Selection Board (SDSB), required by the ISD process, which was held in February, 1982. The SDSB recommended further semantic changes to task titles and added another 16 tasks to the list. The lack of an acceptable quantitative method for task selection and prioritization made it increasingly difficult to stabilize the task list. As a result, the list was subjected to many additional alterations and modifications. In short, closure was needed on the task list to eliminate the recurring amendment process before a final list could be sanctioned by OTSG. To meet this need the Iterative Decision Method (IDM) was developed (Finstuen, 1982; Note 1) and plans were made to test the technology.

Method

Participants

The first major step in implementing the IDM involved the procurement of five expert medical judges to serve in the process. To insure balanced results, OTSG input, Reserve component participation, and Academy Directorate representatives were required. Recommendations from the OTSG consultants on emergency medicine and emergency nursing were requested and an Emergency Medical Service (EMS) physician and Emergency Room (ER) nurse were cited, by name, to participate on the board. Through the National Guard Liaison Office, AHS, an approved Reserve Component 91B incumbent was secured. In addition, the Academy provided two senior NCOs, from the Directorates of Training and Training Development. The five board members constituted the 91B30 Critical Task Relook Board.

Materials and Procedure

The 91B30 task list consisted of 209 tasks, and was divided into 13 duty modules. Modules ranged from 3 to 59 tasks. For the purposes of this paper, the largest and most significant segment, Medical and Surgical Procedures, will be the only detailed module presented. Other modules included topics such as field sanitation, preventive medicine, and combat psychiatry. Overall results also will be included. A detailed technical report covering all aspects of the project is in progress and will be available from DTD at a later date. Table 1 presents examples of some of the medical and surgical procedural tasks.

Table 1
Examples of Medical and Surgical Procedure Tasks in the 91B30 Advanced Medic Course

No	Task Statement
6.	Perform Suturing Techniques
7.	Control Hemorrhage by Ligation of Vessels
9.	Control Hemorrhage by Clamping of Vessels
16.	Don Sterile Gown and Gloves
19.	Identify and Manage Multiple System Trauma
20.	Identify and Manage High Velocity Missile Wounds
28.	Perform EOA, Nasal, and Endotracheal Tube Insertion
29.	Perform Cricothyroidotomy
31.	Perform Chest Decompression
34.	Operate and Maintain Suction Equipment
41.	Perform Urinary Catheterization
57.	Apply First Aid to a Patient With Anaphylactic Shock

A briefing was prepared and presented to each of the participants outlining their mission, and the basic technology of the method. Judges were encouraged to participate in the process regardless of their position on any issue viz-a-viz other judges.

The IDM is a highly structured group judgment model, designed to maximize the effectiveness and efficiency of decision making, for a panel of 5 or 7 experts. The technology draws from several decision making techniques (i.e., Nominal Group Technique and Delphi Processes, Delbecq, Van de Ven, & Gustafson, 1975) and is based upon the research findings of over 70 small group interaction and productivity studies

(Finstuen, 1982). The productivity of the IDM process rested on two critical tenets. First, to maximize effectiveness, independent judgment (J1) results, from a nominal group were used as feedback for making the revised group judgments (J2) under a "pooling-of-abilities" model. Numerous research investigations have shown that discussion and revision of group judgments increases the accuracy of the decisions (Huber & Delbecq, 1972; Shaw, 1971, Steiner, 1972; Thorndike, 1938) and are more motivating and satisfying to participants than purely nominal group judgments (Hackman & Morris, 1975; Hare, 1962; Shiftlett, 1972).

Multiple linear regression equations (Ward & Jennings, 1973) were used to express decisions of the nominal group as a function of dichotomously coded task and rater variables. Group equations for each duty module took the following form:

$$Y = w_1T^{(1)} + w_2T^{(2)} + \ldots + w_nT^{(n)} + w_{(n+1)}R^{(1)} + \ldots + w_{(n+k)}R^{(k)} + c,$$

where Y was a criterion vector of decision scores (length equals k raters times n tasks), $T^{(i)}$, $i = 1$ to n, was a task predictor variable coded 1 if decisions were observed on task i, 0 otherwise; $R^{(j)}$, $j = 1$ to k, was a rater predictor variable coded 1 if decisions were associated with rater j, 0 otherwise; w_1 through $w_{(n+k)}$ were the raw least squares regression weights associated with each predictor, and c was a regression constant. Selection criteria consisted of binary decision scores (Lunney, 1970) and were coded 1 if a task was selected for training, 0 if nonselected. Multiple correlation coefficients, R's, were used as indicators of the goodness-of-fit for the group prediction equations.

Second, to increase efficiency, discussion was directed to disagreements which merited attention, and not to tasks which the experts had already agreed upon for either selection or nonselection. The gross level of group agreement for duty modules was measured by the inter-rater reliability coefficient r_{kk} (Guilford & Fruchter, 1973). Specific task and rater disagreements were identified by examining the squared residual contributions of task and rater variables to the total squared residuals associated with the group equation. With this form of decision making there were no correct or incorrect expert opinions. The objective of the process was to have the group arrive at an acceptable level of agreement in regard to the tasks selected for training; it was not necessary that 100% consensus be obtained. After tasks were selected for training, they were prioritized and categorized through the use of an anchored 3-point combat criticality rating scale (3 = combat critical--tasks crucial to survival in combat; 2 = mission essential--tasks necessary to support the stated mission of peacetime AMEDD organizations; and 1 = other essential--tasks that contributed to the performance of combat critical or mission essential tasks, but did not, by themselves, affect mission attainment).

Clearly, this technology remedied several of the key problems experienced with the CTSB, but most noteworthy was the assurance that all expert judges contributed their expertise individually and as group members, and that the selection decisions were made in an effective and efficient manner. It was anticipated that the technology would provide the needed closure through the stabilization and prioritization of the task list, based upon judgments secured from the medical expert judges.

Data collection began 23 April 1982, by securing independent task selection judgments (J1) from the Academy members and the Reserve Component representative. On 27 April 1982, an AHS team traveled to Darnell Army

Hospital, Fort Hood, TX, to gather data from the EMS physician and ER nurse. The group component of the IDM (J2) was secured 6-7 May 1982 at Fort Sam Houston. DTD sponsored the assembly of all of the judges, and after a review of the J1 findings and procedural briefings, J2 judgments were rendered.

Several actions taken at the convention of the board were of particular assistance to the members. First, to provide a frame of reference for decision making, DCDHCS presented a briefing on the scenario of the modern battlefield and the equipment the 91B30 would have to use. Second, results from an initial front-end-analysis (FEA) of the task list items were made available by several 91B30 subject matter experts. Third, representatives from Collective Training Division, DTD, and DCDHCS were on hand to answer technical questions relating to the needs and requirements of the Army in general. Finally, the project officer served as facilitator to insure smooth procedural operation.

Results

Collectively the board had 70 years of active duty Army medical experience, of which 39 years had been served in Table of Organization and Equipment (TOE) field units. In addition, two enlisted members of the board had combat experience and had collectively served a total of 39 months in Viet Nam. On the average, board members were 35 years old, and had an average of 16 years of formal education.

Selection of Tasks for Training

A summary of the overall J1-J2 selection results and prioritization results is presented at Table 2, together with specific results obtained for the Medical and Surgical Procedures Duty module. As shown, some 97% (100 x .97) of the 290 medical and surgical J1 task decisions were voted as "select". Goodness-of-fit for the group equation ($\underline{R}$ = .55) was modest and the low reliability (.38) for this module indicated that group discussion was required. Figure 1 presents the standardized display, which experts used to interpret disagreements for the medical/surgical duty.

Table 2
Summary of Independent (J1) and Revised Group (J2)
91B30 Task Selection Judgments[a] and Combat Criticality Ratings[b]

Decisions	N Tasks	k x n Judgments[c]	Summary Statistics Mean	S.D.	$\underline{R}^{2d}$	r_{55}
J1 Independent Judgments						
Medical Surgical	58	290	.97	.16	.55	.38
Overall	209	1,045	.93	.26	.56	.40
J2 Revised Group Judgments						
Medical Surgical	58	290	.98	.14	.93	.96
Overall	209	1,045	.97	.16	.63	.61
Combat Criticality Ratings						
Medical Surgical	57	285	2.71	.58	.80	.84
Overall	207	1,035	2.56	.40	.95	.97

[a] Judgments were coded 1 if a task was selected, 0 if nonselected
[b] Prioritization ratings were obtained from 3-point rating scales ranging from 3=combat critical, 2=mission essential, to 1=other essential.
[c] k=5 experts
[d] Multiple correlations were statistically significant from zero, $p < .01$

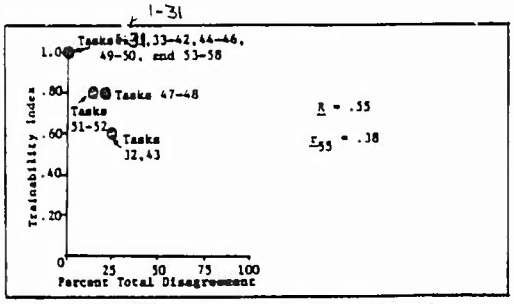

Figure 1. Standard graphic display of J1 independent judgment results for the Medical and Surgical Procedures module.

As shown, task selection averages (trainability indices) ranged from 0 to 1.0 and were plotted vertically. Task information was also plotted horizontally in terms of the amount of disagreement each task exhibited (percent of each task's squared residual sum in relation to the total group equations' sum of squared residuals). Most tasks, clustered in the upper left corner, were selected for training and all raters agreed they should be selected (zero disagreement). However, Tasks 32 (Perform Thoracentesis), 43 (Perform Advanced Cardiac Life Support), 47 and 48 (Pertaining to Pediatrics and Child Abuse), and 51 and 52 (Snake Bite and Antivenom) were disagreed for selection.

After discussion of those particular tasks, the board rendered a revised set of judgments. One task (51) was declared as nonselect by

all members of the board, and four raters decided to select Task 43 while one did not. Because one expert still disagreed on this task, its selection priority resulted in .80. Both goodness-of-fit and inter-rater reliability (r_{kk}) substantively increased for the revised group judgments as a result of the discussion (to .93 and .96 respectively).

This finding indicated that the information exchanged during the revised group judgment phase produced a more carefully considered and agreed upon listing of training tasks, even though 100% consensus was not attained. After the revised group judgments were made, the tasks selected for training (207 out of 209) were rated using a 3-point combat criticality scale (Table 2). Findings for medical and surgical procedures, and for all the modules, indicated that the ratings were stable and reliable. Table 3 presents the results for hypothesis tests of differences among task selection and prioritization averages. These results were used to gauge the effects of task variables in regard to the dependent decision measures, while controlling for the effects due to raters. Full group equation results (R^2_{full}) were tested against results from equations restricted to only rater variables ($R^2_{restricted}$). Significant results were obtained for all comparisons, and as shown, differences among task selection means increased from the J1 to the J2 condition. These findings indicated that raters had differentiated among tasks in terms of selection and combat critical priority, and that the group discussion had indeed enhanced the decision making process for the Medical Surgical module, and overall modules.

Table 3
Summary of Significance Tests for
J1-J2 Selection Decisions and Combat Criticality Ratings

Judgment Condition	k x n Judgments	R^2_{full}	R^2_{rest}	df_1	df_2	F^a
Medical Surgical Procedures						
J1 Independent Judgments	290	.301	.020	57	228	1.60
J2 Revised Group Judgments	290	.866	.002	57	228	25.82
Combat Critical Ratings	285	.648	.080	56	224	6.45
Over All Modules						
J1 Independent Judgments	1,045	.311	.023	208	832	1.57
J2 Revised Group Judgments	1,045	.401	.017	208	832	2.56
Combat Critical Judgments	1,035	.395	.047	206	824	32.32

[a]All F ratios were significant, $p < .01$

Table 4 presents an abbreviated prioritized list of the medical and surgical tasks that were selected for training development. Cut-off points were established to group tasks into three categories as shown. The final overall task list contained 74 combat critical, 109 mission essential, and 24 other essential tasks. Tasks which are identified as combat critical, and certain high priority mission essential tasks, are typically employed as input to soldier's field manuals and serve as a basis for specialty qualification testing. Medical and surgical procedures accounted for 26 of the 74 (35.14%) combat critical tasks. While all 207 selected tasks were grouped throughout the range of possible criticality from .6 to 3.0, finer discriminations would probably be desirable. Future studies would benefit from the use of an expanded 7- or 9-point rating scale or a ranking procedure to determine finer just-noticeable-differences among tasks.

Conclusions

The IDM technology provided the DTD with an effective and efficient method of task selection and prioritization and, in the case of the 91B30, task reaffirmation. Through the combined J1 - J2 decision making process and ratings of selected tasks, over 3,000 expert judgments were directly applied to the task data. The prioritized task list constituted a defensible and comprehensive basis for the identification of training requirements and for the subsequent development of training materials and courseware for the 91B30 Advanced Medical Specialist School.

Yet another significant facet of the technology, of considerable import and utility to trainers, was the ordering of duties and tasks within the list. Given the five judges, each task received a rating from 0 non-select, to 1.0, select, separated by intervals of .2. Thus it was possible to group tasks

Table 4
Selected Medical and Surgical Training Tasks
Arrayed by Criticality Index and Category

Original Task No	Task Description	Criticality Index	Category
6.	Perform Suturing Techniques	3.0	
10.	Apply Surgical Dressings and Drains	3.0	Combat
19.	Identify and Manage Multiple System Trauma	3.0	
29.	Perform Cricothyroidotomy	3.0	Critical
31.	Perform Chest Decompression	3.0	
13.	Prepare Surgical Patient, Perform Minor Surgical Scrub	2.8	
15.	Set up and Maintain Sterile Field	2.8	
30.	Operate and Maintain O_2 Equipment	2.6	Mission
49.	Identify and Manage Bites of Snakes and Animals and Stings of Insects	2.4	Essential
16.	Don Sterile Gown and Gloves	2.4	
56.	List Effects of Common Poisons	2.0	
46.	Prehospital Childbirth Procedures	1.8	
48.	Identify and Manage Child Abuse Problems	1.8	Other
58.	State Source of Information for Poisons not Commonly Encountered	1.8	Essential
43.	Perform Advanced Cardiac Life Support*	.8	

*Task 43 was appended to the list and indexed by its selection priority value.

with similar trainability index values, i.e., .8, .6, .4, .2, and utilize the selection values in conjunction with the priority ratings as task discriminators, if time or monetary resources precluded the training of all tasks. The a priori statement that 100% consensus of task selection during J2 was not required, provided the expert judges with an opportunity to express their opinions in a way that could change training priorities without completely deleting or adding the task for training (Task 43), an aspect that the judges felt was most equitable.

While this first implementation of the IDM at the Academy served as a relook for tasks that had already been through two boards, the value and workability of the system was established beyond any doubt. In fact, use of the IDM under these circumstances provided a very rigorous test for the technology since the J1 task list had already been refined from a larger original list of 443 medical tasks, so decisions required a high degree of discrimination on the part of the expert judges.

In conclusion the IDM has enormous application potential in any performance technology based organization, but is particularly germane to military training for several reasons. First, the quantifiable aspects of collective expertise provide multiple benefits, with a clear audit trail and statistical soundness providing proper task list closure, not the least of them. Second, the expert judges involved in the methodology can provide inter-agency input equivalent to several iterations of normal staffing. Third, a clear course of action for review/revision protocols consistent with initial action can be provided through subsequent boards.

Reference Note

1. Finstuen, K. An iterative decision method for selecting medical tasks for training. Paper to be presented at the 24th Annual Conference of the Military Testing Association, San Antonio, TX, November 1982.

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